Math 114
Dr. Liukkonen
****FINAL EXAM**** **May 5, 2006**

Rules: Calculators, 2 pages of your own notes permitted. Tables IV, VI supplied. No other notes or other assistance allowed. Test conducted under Tulane Honor Code—all work is to be your own.

Do all work on this test paper. Show work—unsupported answers get no credit. If you use your calculator to get an answer, specify the buttons, menus, functions etc that you used.

Questions 1-4 concern the following scenario: A questionnaire seeks information from respondents on the following variables. In each case circle qualitative or quantitative to indicate whether the variable is qualitative or quantitative:

1. Name	qualitative	quantitative
2. Gender	qualitative	quantitative
3. Height in inches	qualitative	quantitative
4. Telephone number	qualitative	quantiative

5. Consider the following sample of quiz scores, arranged in a frequency table:

Score	Frequency
10	4
9	6
8	10
7	20

a) Find the sample mean $\bar{x}$ of the quiz scores.

.b) Find the sample standard deviation of these quiz scores.

6. A population is sixty percent male. Thirty-five percent of males and twenty percent of females in this population smoke. If we choose a population member at random, what is the probability we get a smoker?

7. We toss a fair coin 20 times. What is the probability we get at least 12 heads?

8. An urn contains twelve blue balls and eight green balls. We take a random sample of 7 balls from the urn. What is the probability that exactly five of the balls in the sample are blue?

9. Suppose the random variable X has this distribution:

X	0	1	2	3
Probability	.4	.35	.15	.1

(a) Find $P(X > 1)$.

(b) Find the mean $\mu_X = E(X)$.

(c) Find the standard deviation $\sigma_X = SD(X)$.

10. What do we mean when we say the random variable X has the standard normal distribution? We are looking for an exact concise answer.

11. Professor Smith always uses 95% confidence intervals. Of 400 such intervals, how many are correct, on average?

12. Consider a normal population of measurements with $\mu = 150$, $\sigma = 15$.

(a) We take a single random observation X from the population. Use your calculator to find $P(141 < X < 155)$. Specify which function you used on your calculator, and what your input was in that function. (E.g. if this were a binomial problem you might specify binompdf(15,.5,5))

(b) Answer (a) again using Table IV. Specify all intermediate steps so that I KNOW that you used Table IV.

(c) Use your calculator to find the 85th percentile of this population. Specify the function you used with the input.

13. A normal population has mean $\mu = 95$ and $\sigma = 10$. We plan to take a sample of size $n = 35$ from the population.

(a) What is the mean $\mu_{\bar{x}}$ of $\bar{x}$?

(b) What is the standard deviation $\sigma_{\bar{x}}$?

(c) Find $P(\bar{x} > 97)$.

14. We plan to toss a fair coin 1,000,000 times. Let X be the number of heads we get.

(a) Give the mean μ_X.

(b) Give the standard deviation σ_X.

(c) Give the middle 95% of likely outcomes for X.

15. Here is a breakdown of employment by rank and gender in a large office building:

	Male	Female
Supervisor	50	40
Working stiff	150	260

We choose an employee at random.

a) What is the probability we get a female supervisor? (just set up ratio)

b) What is the conditional probability we get a supervisor, given that we get a female? (set up ratio)

c) What is the conditional probability we get a female, given that we get a supervison? (set up ratio)

16. We take a sample of 250 observations from a huge population of measurements and get $\bar{x} = 55, s = 18$.

(a) Give a 95% confidence interval for the mean μ of the population.

(b) Give a 93% confidence interval for the mean μ of the population.

17. We are doing a statistical study and get various results, to which we attach p-values. Which of the following p-values represents the strongest statistical evidence for the corresponding conclusion? (Circle best answer.)

.04 .18 .52 .92 .9999

18. We take a random sample of 120 from a huge population of measurements and get $\bar{x} = 310, s = 85$. Do we have evidence at significance level $\alpha = .05$ that the population mean μ exceeds 300? What is your p-value?

19. We want to carry out a 95% confidence interval for an unknown population mean μ, based on a random sample from the population. We believe $\sigma \cong 15$ and we want our sampling error SE (margin of error) to be no larger than 3. How large must our sample size be?

20. We want to carry out a 95% confidence interval for the proportion of all Louisiana voters who recognize our client's name, and we want our sampling error SE (margin of error) to be no larger than .025. We want to make no prior assumptions on how large this proportion is, and want to cover all possibilities. How large a sample must we take?

21. Here is a random sample from a normal population:

14.4, 12.4, 15.5, 17.6, 17.4, 18.5

(a) Give a 95% confidence interval for the population mean.

(b) Do these data represent statistical evidence $(\alpha = .05)$ that $\mu < 19$? Be sure to include a p-value.

22. We interview 450 randomly selected Southeast Louisiana adults and find that 175 suffered insomnia in the six months following Katrina. Give a 95% confidence interval for the proportion of all Southeast Louisiana adults who suffered insomnia in the six months following Katrina.

23. A random sample of 6 volunteers is given an accounting skills test, then attends a weekend workshop, then takes another test. The results are below. Do these represent statistical evidence that their scores have improved significantly $(\alpha = .05)$? Give a p-value for your answer.

Subject	1	2	3	4	5	6	7
Before	23	15	27	35	35	39	8
After	24	19	26	41	41	43	13

24. A red beans company claims that its one pound bags of red kidney beans contain 16 ounces of beans on average. We plan a hypothesis test on μ, the average weight per bag for a certain day's production. What null hypothesis H_0 and what alternative H_a should we choose if

(a) we are an investigative reporter who would like to make the company look bad

(b) we are a quality control engineer who is checking that production is proceeding correctly and accurately.

25. . In order for us to reject a null hypothesis, where must the p-value lie in relation to the significance level α?

26. We take independent random samples from two huge populations and get $n_1 = 140, \bar{x}_1 = 135, s_1 = 50$, and $n_2 = 175, \bar{x}_2 = 115, s_2 = 25$. Give a 95% confidence interval for the difference $\mu_1 - \mu_2$ of the population means.

27. To develop a simple linear regression model for a response y in terms of an explanatory variable x, we collected data on x, y and calculated the relevant sums

$$n = 14, \sum x_i = 209, \sum y_i = 277.1, \sum x_i^2 = 4175, \sum x_i y_i = 5255.6, \sum y_i^2 = 6845.53.$$

Using only the relevant sums given here, find the least squares estimates $\hat{\beta}_0, \hat{\beta}_1$, the residual or error sum of squares SSE, and the estimate $\hat{\sigma}$.

28. Below is part of an Excel printout for a regression study of a response y in terms of two explanatory variables x_1, x_2.

a) We would like to know if we have evidence that y varies positively or negatively with either or both of x_1, x_2. Based on the printout, what can we say? Explain.

b) Give a 95% confidence interval for β_1.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.695292
R Square	0.483431
Adjusted R Square	0.409635
Standard Error	4.566779
Observations	17

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	273.2461	136.623	6.550946	0.009815
Residual	14	291.9766	20.85547		
Total	16	565.2227			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.839976	2.309252	0.363744	0.721484
X Variable 1	-0.32644	0.09166	-3.56142	0.003129
X Variable 2	0.073072	0.0992	0.736613	0.473522